BROADBAND FREQUENCY COMB VERNIER SPECTROSCOPY IN THE MID-IR WITH VIDEO-RECORDING RETRIEVAL OF ABSORPTION SPECTRUM

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A spectroscopic technique based on the principle of Vernier frequency comb spectroscopy is developed, which combines the broadband spectral coverage and high spectral resolution with the signal enhancement due to a resonant optical cavity. The resonant cavity serves the dual role of optical path enhancement along with Vernier filtering of the comb modes, allowing individual comb modes to be resolved with a grating. The method uses only one frequency comb laser and by using multiple exposures and taking a sequence of images of enhanced comb modes (i.e. taking video-recording) a constraint imposed on the bandwidth can removed. The bandwidth can be expanded even more by simultaneously recording with the IR camera frequency comb modes from different spectral intervals. The methane absorption spectrum in ambient air in the mid-IR with a frequency comb obtained as a difference frequency generation was measured. Processing the sequence of images recorded with the mid-IR camera as the resonant cavity length is scanned allows the retrieval of the absorption spectrum. The experimental results and the discussion of the advantages and limitations of this techniques are presented. This work was supported by Robert A. Welch Foundation(grant No A1546) and a T3 grant from Texas A and M University.